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do not imply any such close genetic relationship to them as has been suggested" (Proc. Zool. Soc. London, 1884).

Mr. Mason has detected the females, before unknown, which are wingless and of larger size than the males. He also discovered in India larvæ of a species apparently living in society.

ENTOMOLOGICAL NOTES.—A case of sexual attraction in Prionus is noticed by Anna K. Dimmock in *Psyche* for April. A female about to oviposit was caged, when one male after another flew to the cage, so that a great many males were taken in the afternoon. "On account of the presence of so many males a number of females made their appearance, showing an attraction of the female to the male, like that above noted of males attracted by females." Apropos of this fact, Mr. F. Clarkson states in the *Canadian Entomologist* for May, that the presence of *Prionus brevicornis* is quickly realized by the odor of the female, which is very powerful and can readily be detected twenty feet distant. "I placed a female immediately after emergence in an uncovered jar, and wherever I positioned it, on the piazza or elsewhere, the males were attracted from every direction. I captured twenty males in a very few minutes."——Mr. W. H. Edwards contributes to the *Canadian Entomologist* for May, useful directions for breeding butterflies from the egg.——M. Jules Künckel has communicated to the Paris Academy of Science, as the result of his researches upon the movements of the heart in insects during their metamorphosis, the statement that this organ continues to beat during the phenomena of histogenesis. In *Volucella zonasia* and *Eristalis æneus* it was observed that when movement was lost, on the twelfth day in the first species and the ninth in the second, the two great wing muscles were already developed, and the eyes were evident upon dissection. The short period of quiescence of the heart is occupied in the histological changes of that organ, above all in the formation of an aortic region corresponding to the formation of the thorax.——The researches of M. Carlet have brought to light a previously unknown part of the sting of the honey-making Hymenoptera. The poison-bag of these insects is destitute of a muscular wall, and is thus incapable of emptying itself, but the stylets of the sting are furnished at their base with a veritable piston which moves within the length of the base of the sting, and whether the stylets move simultaneously or alternately, at each movement forces a drop of venom into the wound and produces a new afflux of liquid at the base of the sting, which is thus at once an aspirator and an injector.

ZOÖLOGY.

NEW CLASSIFICATION OF THE ROTIFERS.—Dr. C. T. Hudson, in the *Quarterly Journal of Microscopical Science* for July, attempts a re-classification of the rotifers. His paper, which is illustrated with figures of nearly each genus, will prove very useful to American microscopists. After remarking upon and criticizing the systems of Ehrenberg, Dujardin, Leydig and Bartsch, he offers one of his own. The class Rotifera falls, he thinks, into four natural orders, according to their modes of locomotion. "There are some that swim only; others that both swim and creep like a leech; those that both swim and skip; and lastly, those that when adult are fixed; and these orders differ in the main from each other in the form and use of the foot. In each order, too, there are typical genera, round which the rest may be grouped, differing from each other in the shape of the trochal disc and the position of its ciliary wreaths, as also in the structure of the manducatory organs, and sometimes in other important points as well."

The form of the mouth-parts affords good family characteristics, while a difference in the shape and disposition of the trochal disc and its ciliary wreaths generally accompanies a difference in the manducatory organs, the two together serving "as good guides to a re-classification of the rotifers into families, which the author attempts to do.

Dr. Hudson's system is as follows:

CLASS ROTIFERA.

Order I. RHIZOTA.—Fixed forms; foot attached, transversely wrinkled, non-retractile, truncate. Family 1. *Flosculariadæ* (Floscularia, Stephanoceros); Fam. 2. *Melicertadæ* (Melicerta, Limnias, Œcistes, Cephalosiphon, Lacinularia, Megalotrocha, Conochilus).

Order II. BDELLOIDA.—That swim and creep like a leech; foot retractile, jointed, telescopic, termination furcate. Fam. 3. Philodinadæ (Philodina, Rotifer, Callidina).

Order III. PLÖIMA.—That only swim. Fam. 4. *Hydatinadæ* (Hydatina, Rhinops); Fam. 5. *Synchætadæ* (Synchæta, Polyarthra); Fam. 6. *Notommatidæ* (Notommata, Diglena, Furcularia, Scaridium, Pleurotrocha, Distemma); Fam. 7. *Triarthradæ* (Triarthra); Fam. 8. *Asplanchnadæ* (Asplanchna); Fam 9. *Brachionidæ* (Brachionus, Noteus, Anuræa Sacculus); Fam. 10. *Pterodinadæ* (Pterodina, Pompholyx); Fam. 11. *Euchlanidæ* (Euchlanis, Salpina, Diplax, Monostyla, Colurus, Monura, Metopidia, Stephanops, Monocerca, Mastigocerca, Dinocharis).

Order IV. SCIRTOPODA.—That swim with their ciliary wreath, and skip by means of hollow limbs with internal locomotor muscles. Fam. 12. *Pedalionidæ* (Pedalion).

THE NATURE OF ECHINODERMS.—At the Paris Academy of Sciences M. Viguier reviewed the various theories respecting the nature of echinoderms. Some, as Cuvier, the elder and younger Agassiz, and Metchnikoff, considered them as simple radiate animals approaching the acalephs and ctenophores; while others, as Leuckart and Claus, believed that the worms, especially the gephyreans, were their nearest relatives. A third opinion, originated by Duvernoy and sustained by Haeckel, regarded an echinoderm as the result of the union of five vermiform organisms, and lastly M. Perrier considered it as composed of five reproductive individuals grouped around a nutritive individual. The last theory accounted for facts which could not be explained by that of Haeckel. M. Perrier communicated the details of his researches upon the anatomy of adult Comatulæ. From these researches, based upon more than two hundred sections, it appears that the organization of a Comatula is singularly like that of other echinoderms, notwithstanding the apparent wide divergence. If a sea-urchin is considered as a crinoid, the arms of which have become attached to the surface of the voluminous disk, and the mouth of which is placed at the point of insertion of the disk upon the stem, the nervous and ambulacral systems will have the same relations as in the Comatula. It is worthy of notice that at this spot the calyx of many crinoids is invaginated, and presents points not without analogy with the dental apparatus of the sea-urchins.

DESTRUCTION OF DOG-FISH BY AN ISOPOD CRUSTACEAN.—From a communication made by Dr. Day to the Zoölogical Society of London (Feb. 5, 1884) it appears that an elongated Isopod (*Conilera cylindracea*), some of which attain a length of one and a-quarter inches, devour the soft parts of the dog-fish, muscles and entrails. On one occasion 100 dog-fish were netted, and "nearly every fish was found to have been eaten in a like manner by the lice." These "lice," as the fishermen call them, "in the summer months are found from fifteen to twenty miles from land, generally on soft and sandy bottoms. When the fishermen in foggy weather get on this bottom, they call it 'lousy ground.' Where the lice are abundant they drive away the congers and other fish. Often a shoal of bream will come and eat them up."

ARE THE "CHIMNEYS" OF BURROWING CRAYFISH DESIGNED?—In *Nature*, No. 726 (June 5, 1884), Mr. Ralph S. Tarr gives an interesting account of his observations of the chimney-building crayfish (*Cambarus diogenes*). His conclusions and my own with reference to this crustacean tally except upon one point. Mr. Tarr remarks, "I do not think the chimney is a necessary part of the nest, but simply the result of digging." On the contrary, I am convinced that the crayfish *builds* his chimney or tower; that he often studies the locality with care and *builds* to suit the chosen site. My reasons for this conclusion are: That a large series observed during the present year were so placed on a steeply sloping bank of a ditch, that if the materials of which the towers were composed had been simply rejected matter derived from tunnelling, then it could have been rolled into the ditch without trouble, while in fact an artistic tower, only two inches in diameter and varying from eight to eleven inches in height, was erected; and in several instances the base of the tower was specially provided for by having the ground leveled and smoothed before the foundation masses of *puddled* clay were put in position. Of a series of forty towers built by the *Cambarus diogenes* that I observed on the banks of a ditch, not one could have been the result of accident, as suggested by Mr. Tarr.

The towers that were found in the meadows, at a considerable distance from open water, were invariably broader at the base, and never so high as those described as found on the edge of flowing water. These open-meadow towers or chimneys, however, were all found to be composed of pellets of clay so arranged as to render it highly improbable that their positions were fortuitous. Indeed, in the majority of instances it would have been practicable to have rolled the little balls of clay to a considerable distance from the opening of the tunnel.

Perhaps there is a bearing on the question of design in tower building in the fact that often half-grown or even smaller crayfish of this species build the most elaborate structures. Some of the finest examples, *i. e.*, the most slender and tallest were the work of diminutive little fellows which certainly could have avoided a deal of labor if the chimneys or towers were not designed.

I have never seen a *Cambarus diogenes* in the act of tower-building, nor been able to determine why they tunneled at all. When this is determined I believe the towers will be found to have a close connection with the purposes of the subterranean haunts of the burrowing crayfish.—*Chas. C. Abbott.*

THE CRUSTACEA OF THE TALISMAN EXPEDITION.—The *Talisman* brought home a fine collection of Crustacea from all depths. Swimming crabs appear to be rare at great depths, yet species of Bathynectes were found at from 450 to 950 meters off Morocco and the Cape Verde isles. Anomoura were abundant at very great depths and usually belonged to transition forms. Some of these have a very wide distribution, thus *Homola cuvierii*, previously thought to be exclusively Mediterranean, was found at the Azores and Canaries, and a species of Dicranomia described by Milne-Edwards from the Antilles, was found at the Azores. Some Galatheas were taken from the interior of the sponges of the genus Aphrocallistes. *Galathodes antonii* and *Ptychogaster formosus*, a species with its abdomen twice coiled upon itself, were dredged at 4000 meters. A considerable number of genera and species of Eryonidea were taken.

A remarkable new shrimp is *Nematocarcinus gracilipes*, with wonderfully attenuated feet and antennæ. In *Glyphus marsupialis*, another Caridean, the female has the lateral portions of the abdominal segments developed into a sort of pouch for the reception of the eggs.

RACES AND HYBRIDS AMONG THE SALMONIDÆ.—Dr. F. Day publishes additional facts on this subject in the Proceedings of the Zoölogical Society of London for 1884, p. 17. His previous observations, published in 1882, tended to show that the number of species existing in Great Britain had been unduly multiplied by local races or varieties which were considered as species. Dr. Day first describes a hybrid between *Salmo salar* and *S. levenensis*, the Loch Leven trout. Here it may be said that he has raised several parrs " with comparatively large ova, which were of a deep reddish color, thus almost disposing of the statement that 'no parr has ever been found with mature ova' [Gunther's Introduction to the study of Fish, p. 639]. Certainly the ova were not mature, but would have been had the fish not met with an untimely end while the parr-marks were present, and so likewise were the silvery scales of the smolt. And as I shall show, we found at the end of November other females with ova, in all of which the parr-marks were visible."

His observations also " conclusively show that the females, without descending to the sea, may develop eggs in fresh water. And though we know that in the case of rivers in which their access to the sea has been cut off, or their migrating to the ocean prevented from any cause, these fish have usually disappeared from such streams, still we are aware that land-locked salmon are found in various parts of the globe."

On Nov. 15, 1882, 8000 ova were taken from an American charr (*Salmo fontinalis*) which were fertilized with milt from a Loch Leven trout; many of the young were more or less and variously deformed. "It is interesting to observe that about one in six of the eggs of the Loch Leven trout impregnated by the American charr failed to hatch, but double that number, or one in three, of the American charr eggs impregnated from Loch Leven trout-milt. The same reason which appears to militate against trout-eggs being impregnated by salmon-milt probably is the cause, *i. e.*, the size of the spermatozoa. Thus the comparatively large Loch Leven trout-eggs were fertilized from the milt of the charr; but when the converse was tried the success was much less. As the American charr-eggs are much smaller than those of the Loch Leven trout, it is reasonable to suppose the spermatozoa are also smaller, and consequently were readily absorbed; but when it was attempted to fertilize the *Salmo fontinalis* by the milt of *S. levenensis* probably the large spermatazoa did not readily find entrance, thus accounting for the great proportion of unhatched ova. * * * *

" An exceeding interesting subject of investigation is whether we possess several or only one species of river trout. The foregoing descriptions of hybrids show that although neither the salmon nor Loch Leven trout possesses white edges to the dorsal and anal fins (such being usually restricted to the brook trout), hybrids between the two appear invariably to be so marked. This year's investigations at Howietown have likewise shown that such a mode of color may occur in old Loch Leven trout, especially males."

After detailing experiments in raising young from eggs of American charr fertilized by Scotch, Dr. Day finally remarks: "Considering that these fishes have shown no tendency to monstrosities, have been well formed, and grown fairly in proportion to the young of the true American charr hatched at the same time, I cannot resist thinking that it may be possible that these two fish, although so widely differing in color, may be merely varieties of one species, descendants from one common stock. This question, however, will be more appropriately discussed when we possess fish a year or two older."

ACCELERATION IN DEER ANTLERS.—Besides the white-tailed deer mentioned in my note in the July, 1884, number of the NATURALIST, I have in my collection the antler of a *Cervus macrotis* found near Carter, on the Rocky mountains, which is *abnormally* flattened, which shows no indication of having been injured, and so tends to support your position. It is doubly bifurcated. For four inches above the burr it is cylindrical and five and a-half inches in circumference. There it throws off a basal snag two inches long. Thence it commences to flatten, and at the first bifurcation, seven inches above the snag, it is six inches broad, whence the upper prong extends seven inches to its fork, where it is four inches wide. Above this the tines are seven inches long, and gradually assume the cylindrical form to their points. This description would answer for the lower branch except that it is not so wide by half an inch.

It is the largest antler I have ever seen from a mule deer, and is the only one I have ever seen showing a tendency to flatten. There is not the least indication of distortion, but it is perfectly symmetrical in all its parts.—*J. D. Caton.*

[*Note by the Editor.*—This case is paralleled by one observed by myself in a store in St. Paul, Minn., during the summer of 1883. This is a black-tailed deer which has one of its horns completely palmated as in Alces, while the other shows much less palmation. As I explained in the July NATURALIST, this is a case of the process of acceleration, which resulted in the creation of the genus Alces.—*E. D. Cope.*]

HABITS OF THE PANTHER.—I was much interested, as I presume many others were also, in the carefully written and, as I believe, generally accurate account of the cougar, or panther (*Felis concolor*), by Mr. Livingston Stone, in one of the recent numbers of the *Forest and Stream.* As any information regarding this rare and formidable animal is usually read with avidity by those at all interested in the fast disappearing denizens of our forests and mountains, I am tempted to add a few items of my own observation upon the habits and characteristics of this great cat, more especially as my experience in one or two minor points differs somewhat from the conclusions of Mr. Stone.

Seldom found very abundantly in any portion of our country, when compared with other wild animals of equal size, and still more rarely killed, unless by poison, the panther is nevertheless usually the first animal which disappears before the advance of civilization. They are extinct in most localities long before the deer or bears have suffered any serious diminution in numbers. Upon many portions of this coast, however, panthers are still frequently met with. It has always been a perplexing matter to my mind why the pioneers, many of whom were well acquainted with the animal as found in the Eastern forests, and knowing it there as the cougar or panther, should have straightway set about calling the same animal which they found here the California or mountain lion. Certainly in appearance the two panthers are so nearly alike that no one would dream, upon comparing them, of regarding them as distinct species.

As to their habits, my ignorance of those of the Eastern animal prevents me from comparing them in that particular. Only upon one point I can speak, and on that so far as my knowledge extends, and also from the assertions of many old hunters and trappers who were perfectly familiar with them. The panther of the West coast never indulges, for his own entertainment, in those fierce, cat-like screams with which his eastern brother occasionally makes the night hideous when hungry or lonely. I have heard their savage yell as far west as the Raton mountains on the Santa Fè trail, but although I have hunted and camped for weeks and months at a time all through the Sierra Nevada coast and Cascade ranges, from Washington Territory and Oregon in the north, to the Mexican line of San Diego in the south, in many parts of which the panthers were so abundant that their fresh tracks could be seen daily, I have always listened in vain there for their characteristic cry.

The more I learned of them in their native haunts the more skeptical I became in regard to their ever willingly attacking a man. I have known them on several occasions to follow persons a short distance, and I have seen wolves do the same thing, especially when I have been packing in freshly-killed meat, but I do not believe that in either case they meditated an attack. In one instance, in the Cascades near the Hood, I knew a panther to jump at a man as he lay at night in his blankets, but as soon as the man partly arose and shouted for assistance, the animal bounded into the brush and disappeared. In talking it over we all came to the conclusion that the panther had seen the man move under his blankets and had mistaken him for some less formidable antagonist, and that when the deception was revealed to him he threw up the job at once. As for those stories we read occasionally about their chasing a man on horseback for several miles, in which the writer assures his readers that he only escaped being devoured by being providentially mounted upon the fastest horse in all that section of the country, they appear so absurd to to all hunters acquainted with the animal in question, that they are looked upon at once as extracts from "Dashing Dick of the Wild West," in the dime novel series.

That the panther will run from and tree before the smallest yelping cur that can be induced to follow his trail is true, but I am satisfied that instinct in some mysterious manner warns them of the hunter behind the dog, and that it is the latter only which they hold in fear. This I have demonstrated to my own satisfaction, and have had it corroborated by others. Upon one occasion I followed a panther that was being chased by a settler's dog in the dense hemlock and spruce forest through which the Clascanine river, in Oregon, runs, and although the plucky little cur treed him at least a dozen times, I did not succeed in obtaining the slightest glimpse of the brute, and after chasing him from early dawn until late in the afternoon, through the most terrific wilderness of almost impenetrable thickets, immense fallen trees and giant ferns, I found myself so completely used up that I was forced to relinquish the pursuit from sheer fatigue.

In this instance the panther must have paid but little attention to the dog after he treed, but put in the time listening for my approach, and as soon as that was ascertained he would jump at once to the ground, continue his flight for perhaps half a mile or more, when he would again take to a tree and the same thing would be repeated. Two or three times, where the ground was particularly favorable, I got near enough to hear him leave the tree, which he seemed to do just as readily as if there had been no dog there.

In regard to their manner of climbing, they ascend the immense trees near the mouth of the Columbia, which are frequently 300 feet high, and sixty, eighty or even a hundred feet to the first limb, precisely as a cat would climb them, and, when wounded, will sometimes go to the very top. In one instance I found in a small glade in the forest where, from the sign, it was evident that two or more of them had been gamboling, and like kittens scurrying around in the grass, and then bounding against the trunk of a tree at a point at least ten feet from the ground, they had ascended apparently on the run, tearing off great pieces of bark, and leaving claw marks a foot long on each side.

Although they may in some localities spend the day in lying upon the limb of a tree, I think they always prefer rocky ledges and caverns for that purpose, where such are accessible. In San Diego, near the Arizona line, the rugged, rocky ranges furnish admirable retreats for panthers, there usually called mountain lions; and although not so abundant, they are, I think, more frequently shot than they are further north, for reasons that will soon be explained. Like all of the cat tribe they are partial to warmth, and upon days when it is rather cold in the shade, they frequently come out of their lairs in the middle of the day and lie upon the rocks near by to bask and drowse in the warm sun, and as the ranges there are generally very sparsely timbered, they are occasionally discovered by hunters, when the chances of getting within shot are better than under almost any other circumstances. But for all that, they are animals that are seldom shot, no matter how abundant they may be, and their disappearing so rapidly before the march of civilization is a mystery that I can only solve by the conclusion that being such a large and entirely carnivorous animal, they are immediately affected by the least thinning out of the large game, and are driven by hunger to seek places where the rifle has not begun its deadly work, unless, as they seem to have done on the McCloud river, they turn their attention to the stock of the settler.

Many of them are poisoned by the sheep and cattle men of the southern counties, when their visits to the flocks and herds become too frequent. I have often seen their hides nailed to the walls of the lonely cabins of the stockmen there, and, upon inquiry, have found that they were poisoned in at least three cases out of four.

I entirely agree with Mr. Stone in the belief that a panther would be no match for a grizzly. It is quite possible that their superior agility might sometimes make them more than a match for a black bear, but I can only conceive of their being able to kill a grizzly by fastening upon him in a position where the bear was unable to inflict any injury upon them, as a single, well-directed blow from the paw of a full-grown grizzly will crush in the ribs of an ox, and would, I fancy, leave but little fight in any panther.

With a single incident to illustrate the idea that it is the hunter and not the dog the panther fears, I will close this already lengthy article. In the summer of 1868 I was in Port Gamble, on Puget sound. A trail leading to Port Madison, eight or ten miles distant, was the only land route open in any direction, and that ran through an unbroken forest the entire distance. One of the workmen at the saw-mill at Gamble was returning along the trail from Madison, one afternoon, having with him a favorite little dog, who was trotting along a few yards in advance, when a panther bounded suddenly from the brush and, snatching up the dog, disappeared with the quickness of thought on the other side of the way. The man stated that it was so quickly done that he seemed to take the dog without stopping in a flying leap across the trail.—*Forked Deer*, *in Forest and Stream.*

ZOOLOGICAL NOTES.—*Fishes.*—In Switzerland, according to M. V. Fatio, the minnow reaches an altitude of 2400 meters, and the miller's thumb one of 2200 meters. The perch stops at 2000 meters, and no others pass above 800 meters, although the carp, tench, rudd, roach and chub have been successfully introduced into waters at from 1000 to 1700 meters in altitude. *Gobius fluviatilis* has ascended the Po to the confines of Switzerland, and *Blennius cognata* occurs in abundance in Lake Maggiore and in the Lake of Bourget in Savoy.

Mammals.—MM. Pouchet and Beauregard have been led by the examination of a portion of the "case" containing the spermaceti of the cachalot, to emit the supposition that the "roots" of this case may be the analogue (homologue?) of the posterior region of the right nasal fossa, while the reservoirs situated anteriorly may represent the smooth part of the same nasal cavity, separated from the spouting sacs or opening into them only by an extremely reduced orifice. The walls of the part of the case examined consisted of mucous membrane fifteen millimeters thick, with the surface raised into convolutions separated by fissures in such a way as to recall the surface of the brain. The secretion is thus non-glandular and approaches, physiologically, the secretion of wax by the bee. The structure of the case of the cachalot does not recall any organ present among mammals.

PHYSIOLOGY.[1]

THE PHYSIOLOGY OF RUMINATION.—As is well known, the stomach of a ruminant animal is a complex organ consisting of four distinct chambers. Of these the last, that opening directly into the intestine, corresponds functionally to the single stomach of other vertebrates, the other chambers of the herbivorous stomach probably only being concerned in the preparation of food preliminary to digestion. The feeding of ruminants is characterized by the fact that the food when first swallowed passes only as far as the first and largest division of the stomach, the paunch, where enormous quantities may be laid up. When the animal has ceased feeding it seeks a position of rest and then begins a regurgitation by piecemeal of food from the paunch into the mouth, where it is thoroughly masticated, "chewing the cud," after which it is swallowed into the "fourth stomach" for final digestion. It is this process of rumination which Professor Luchsinger has recently studied in the goat.

Attention is called to the fact that the act of rumination is interrupted if the animal is disturbed in the slightest degree. The goats experimented on were narcotized with morphia, which numbs painful sensations but interferes little with reflex action. After appropriate operations, the author was enabled to assure himself that pressure with the hand upon the wall of the paunch brought about in perfectly normal manner the act of rumination, there was first a movement of the vocal cords tending to close the glottis, then the diaphragm contracted so as to press upon

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[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.